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PROCEEDINGS OF THE PHILADELPHIA FOUNDRYMEN'S ASSOCIATION.

The fifth annual meeting and sixty-second regular meeting of the Foundrymen's Association of Philadelphia was held on Wednesday evening, November 4th, at the Manufacturers' Club in that city. President Francis Schumann was the chairman.

To shorten the proceedings it was decided to dispense with the reading of the minutes of the last meeting.

Treasurer Josiah Thompson presented his report, which showed a balance of $1,567.91 in the treasury.

The election of officers for the ensuing year was the next business, and Secretary Howard Evans read a list of gentlemen nominated at the last meeting. To make the election unanimous a motion was made and carried directing the Secretary to cast the necessary ballot. The following were therefore declared elected to office:

President, P. D. Wanner, Reading Foundry Co., Ltd., Reading, Pa.; Vice-President, Thos. Devlin, Thos. Devlin & Co., Philadelphia; Treasurer, Josiah Thompson, J. Thompson & Co., Philadelphia; Secretary, Howard Evans, J. W. Paxson & Co., Philadelphia; Executive Committee—Walter Wood, Chairman,

R. D. Wood & Co., Philadelphia; Thos. Glover, Glover Bros., Frankford, Philadelphia; E. E. Brown, E. E. Brown & Co., Philadelphia; Stanley G. Flagg, Jr., Stanley G. Flagg & Co., Philadelphia; Wm. F. Sauter, G. Rebmann & Co., Philadelphia; Ex-Officio: P. D. Wanner, President; Howard Evans, Secretary.

The Chairman then made some congratulatory remarks about the good selection that had been made of officers for the ensuing term. He said, among other things, that they were representative of the foundry business and believed in the future of the Association, which was in this case very essential. The idea of bringing the foundry business forward as a special industry and giving it the measure of prominence it deserved was something new, and with such men at the head of the Philadelphia Association success would always be certain.

New business being in order, Jas. S. Stirling then read the following paper by James A. Beckett, of Hoosick Falls, N. Y.:

"THE PHILADELPHIA CONVENTION AND FOUNDRY DEVELOPMENT."

The foundry business has had, within the past few years, and is still undergoing such a change as no other similar branch of manufacturing has seen since the revolution in steel making through the introduction of the Bessemer process.

Within a comparatively short time the methods of carrying on foundry operations have been discussed in the trade journals to an extent that would have been impossible a few years ago, for the reason that no one who considered himself an expert in foundry management could be induced to discuss the subject in any but the most perfunctory manner.

A few years ago each foundry manager guarded the records of his own experience, which, under the best conditions, were plentifully sprinkled with mistakes, as the most valuable of his possessions; and if questioned as to his experience with any of the phenomena arising in the course of every day practice, would try to surround the matter with so much mystery that it would be manifestly improper to talk about it aloud in a public place.

To those who were financially interested in the foundry as a necessary part of a manufacturing enterprise, the foundry was looked upon as the most unsatisfactory conundrum connected with the business; a branch of the business which was capable of no improvement; whose success depended entirely upon luck and chance. It did not take very much investigation to establish the fact that in the foundry where the most profound mystery was to be found there could also be found the most profound ignorance of the principles which form the basis upon which correct practice must be founded, and that as a rule the air of mystery was used to cover up ignorance which could be successfully concealed in no other way.

There has been a great advancement in the direction of foundry literature. Twenty years ago there was very little written upon the subject, and a comparison of it with what has been produced within the last few years shows that great progress has been made.

It is an encouraging sign of progress that the little light that has been thrown on foundry work during the past few years has awakened such a desire for more light upon questions relating to foundry operations and management that the journals devoted entirely or in part to the foundry trade have fairly teemed with questions and discussions of some of the subjects which formerly were surrounded with an impenetrable mystery.

The thirst for knowledge, which practically marks the dawn of a new era in the business, was already becoming very noticeable when the question of having a national convention of foundrymen was brought before the foundrymen of the country, with many misgivings as to the benefits to be derived from it. A large number of those engaged in the business signified their intention of being represented at the convention in Philadelphia on the 12th of May last. It was a gathering which was altogether unique in its character, as it brought together in conference for their mutual welfare and for the friendly exchange of ideas, for the first time in this country, representatives of a business which embraces over 4,000 separate establishments, with a capital of $115,000,000, which gives employment to over 120,000 persons.

The conditions under which the foundry business had been carried on in the past added to the feeling of uncertainty, as it seemed as if it were practically impossible to get a lot of people together in this way and have them agree upon anything definite or satisfactory, who had spent their lives in an atmosphere of suspicion and distrust of each other.

As soon as they reached the City of Brotherly Love, however, and came in contact with the Reception Committee, and under the influence of the genial atmosphere of the committee's headquarters at the Manufacturers' Club, there was a general thaw. The ice of reserve and distrust disappeared and they vied with each other in making the Philadelphia convention a landmark in the history of the foundry business of this country.

The programme provided by the promoters of the movement left nothing to be desired in the way of enlightened discussion of live topics which are attracting the attention of foundrymen to-day. But by far the most valuable result of the convention to the individual was in the opportunity afforded for the quiet interchange of ideas and experiences, in a conversational way, which was kept up during the stay of the delegates in the city, and was of inestimable value in the way of shedding new light upon the obscure places in the personal experience of many who had come upon the different problems of foundry practice which at times do not seem to be capable of any explanation; while they in turn contributed in the way of their own experience on other phases of the subject information as valuable as any which they received, fully demonstrating a truth which has gradually been dawning upon a large number that the foundryman who knew all that was to be known of the business has been dead several years. Another noticeable feature of the convention was the large number of allied industries represented, of pig iron, coke, machinery and foundry supplies, generally affording an opportunity for the discussion of the various conditions which have to be met, and the varied requirements of different branches of the trade. This feature formed a valuable part of the great undercurrent of the convention, and though it was not of such a nature as to be within the reach of those who compiled the pub-

lished transactions, it will bear fruit in the near future in the way of enabling the producer of our raw material to get a better understanding of the causes which up to this time have made it difficult for them to meet conditions of trade which have been only partly understood by the producer or the consumer, and which cannot fail to result in improving the product of the foundry through the improvement which is sure to follow in the character of the materials which the founder has to use.

An evidence of the transition state through which the foundry business is now passing was shown in the great interest manifested by the delegates in the work of Mr. C. James and his assistants, when making a chemical analysis of foundry irons, and their interest in the admirable paper in which he demonstrated the value of what is virtually a new departure in the business of making mixtures of iron for foundry purposes. While not wishing to detract from the benefits derived from the many valuable papers read during the three days' session of the convention, I am led to mention this one because of the attention which it attracted and the eagerness with which the subject was discussed everywhere the delegates congregated during their stay in the city. To many of them it was the first practical demonstration of a theory which had attracted their attention in a measure during the last four or five years. Everything that has been written upon the subject, so far as it relates to the foundry, has commanded instant attention, but this practical illustration appealed to them with greater force, and to many it pointed a way by which they could in the future avoid the expensive mistakes of the past, and a possibility of learning the exact truth in regard to any future trouble, which would help them to select the proper remedy without depending upon the old system of experiment and guesswork, with the guesses mostly on the wrong side.

There has been more study of this question during the past two years than ever before; and it is safe to predict that at the next convention it will be given a more prominent place on the programme.

That there is some opposition to the application of chemistry as an aid to foundry practice is to be expected. It has proved to be of the most vital importance in steel-making, although there were many good people in the business who predicted its utter failure. Its adoption in foundry work has been retarded in some instances by assumption on the part of a few of its advocates that it would make practical experience unnecessary. This stated by Mr. James, "Chemistry is not intended to supersede, but to aid and strengthen practical foundry experience. The chemical analysis of iron is only the handwriting on the wall, and needs interpretation by the light of practical application before it can be of use to the iron founder." This statement cannot fail to be beneficial, as it will correct the erroneous impression before alluded to.

Practical experience is one of those acquirements which cannot be ignored in any branch of the business. The skill of the foundry man is the result of experience, in a delicate handling of component parts of a mold. The successful management of a foundry depends upon the possession of a sufficient amount of skill, together with judgment and discrimination in dealing with the elusive problems which are constantly coming up in everyday practice, which can only be attained by an intelligent application of practical experience.

The benefits to the whole foundry business from the work of the convention are already beginning to show themselves in the increasing amount of discussion that is going on within the lines which the work of the convention suggested, and which is sure to grow to still greater proportions as the business outlook becomes brighter, bringing the maker, the seller, and the user of the raw materials used in the foundry, into closer relations with each other, which will result in a better understanding of the requirements of the one and the difficulties which have to be surmounted by the other. With the added light of a more intelligent interpretation of practical experience, much of what has been a mystery will be cleared away, and the founder will have a more reasonable assurance of producing a given quality of product when, by reason of a more accurate knowledge of his

stock and the changes which take place in the process of manufacture, he will be better able to secure uniform results; and when any variation does occur he has within his reach the means of determinining accurately the cause of such variation without the necessity of resorting to expensive and oftentimes unsatisfactory experiment.

The promoters of the Philadelphia convention of foundrymen have earned the gratitude of the foundrymen of America for the able manner in which they carried the business of the convention to a successful close. The educational work begun under such favorable auspices will not die out, but will continue to grow in influence and increase in value until foundry operations generally, and particularly the work of mixing irons for foundry purposes, will be conducted on the basis of a knowledge of the truth which has given the steel makers of to-day the proud position which they hold among the great industries of the world.

After the conclusion of the reading of the paper of Mr. Beckett, the chairman stated that Mr. Beckett was a stranger, perhaps, to many of those present, although others would remember him very well, he having been in attendance at the May meeting of the Foundrymen's Association in Philadelphia. He took occasion to say that he was one of the most practical foundrymen he had ever met, was with the Walter A. Wood Company, of Hoosick Falls, N. Y., and his paper certainly carried out the idea of many of the best known foundrymen of the country connected with the foundry business.

The chairman then introduced John A. Penton, of Detroit, Secretary of the American Foundrymen's Association, who confined his remarks largely to the Association and its affairs. He outlined what had already been accomplished and gave an intimation of its future policy.

The Secretary drew the attention of those present to a piece of slag sent to him by Abendroth Brothers, of Port Chester, N. Y. He said it was slag from their cupola and, as those who looked at it could easily see, was of a very light and spongy nature, and such as they had never seen before. Mr. Evans said they

used coke for fuel and wondered how the slag was formed and what it consisted of. After the specimen had been handed around for inspection, Dr. Kirk said, in response to an inquiry, that very little could be told of its nature without further particulars. He said he was acquainted with the cupola, that it worked very rapidly, melted about 15 tons per hour, and thought they used a large amount of limestone, and this peculiar slag was probably due to the limestone forming a slag at some point above the tuyeres, and that its operation indicated that that was the secret of its formation. After Mr. Landis had kindly consented to make a chemical anlyasis of the specimen, Mr. Evans spoke of a firm who had the contract or were about to secure the contract for making a large quantity of castings that were required to stand a tensile strain of 28,000 pounds, and that the foundryman who was about to secure the contract wondered whether it would be possible to make a mixture in their cupola strong enough to resist the strain. That question also brought up another one that had been discussed previously as to whether it would not be possible and even advisable for the Association to secure the services of a competent chemist who would be at the disposal of the members of the Association and could serve them when they called upon him, free of charge, or upon the payment of a small fee.

The Secretary's remarks brought out a very lively discussion. Mr. Warner thought it would not be wise to make such a move at present; Mr. Devlin thought it was difficult to find such a man; Mr. Hibbs knew of foundries aleady in Pennsylvania making castings of the strength mentioned from iron melted in the ordinary cupola, and Mr. Schumann pointed out that one very well-known Philadelphia concern had already made iron in their cupola that would stand 40,000 pounds, while almost any iron could be mixed from standard brands that would stand a strain of 22,000 or 23,000 pounds, and others made comments of various kinds, but nothing was done in the matter.

After the meeting adjourned the members proceeded to the cafe on the roof of the Manufacturers' Club, where they sat down to an excellent supper. Advantage was taken occasionally of the few addresses made by the President and newly elected Vice-President principally, other speakers being Messrs. Birkinbine, Rankin, Regester, Penton and Evans.

PROCEEDINGS OF THE WESTERN FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Western Foundrymen's Association was held Wednesday evening, November 18, 1896, at the Great Northern Hotel, Chicago, Ill. In the absence of the president Mr. Wm. Ferguson occupied the chair.

Mr. Ferguson as chairman of the committee on cores, reported that the committee had enough material on hand to make a report, which will be ready for the next monthly meeting.

The report of the committee on apprenticeship was then submitted for discussion.

Mr. Ferguson: This report was read at the last regular meeting and the discussion of the paper held over until to-night. (The report will be found in the November Journal.—Ed.)

Mr. Carver: As a member of the committee appointed to consider this question, I can only say that the ideas that are embodied in the general report of the committee contain, to the best of our judgment, all of the recommendations that the question would merit, and I cannot too strongly urge upon this association the consideration of the recommendations of that committee in the first clause of their report, in which the wish is expressed that this association take some definite action that will encourage foundrymen to adopt some such system. We all, as employers of labor and as men in charge of workmen and work, know that it is to the best interests of any class and to the best interests of every employer to have skilled labor, to have all of his labor educated as much as possible in their several lines, and no better means can be adopted than that recommended by the committee. In having a definite system of apprenticeship we shall school a certain class of workmen in their duties in the foundry. It makes no difference whether a young man enters upon his ordinary vocation of life in the foundry, machine shop, pattern room or carpenter shop, the more education he can acquire the more he can make himself familiar with the fundamental principles of the trade he has

adopted, the better work he can do for himself and the better work he can do for his employer. This point to which I refer seems to me to cover broadly the idea the committee had in mind in making its report, and in urging this association to take some definite action in regard to encouraging manufacturers to adopt this system. If adopted by the members of the Western Foundrymen's Association it would be found just as available for adoption in the ordinary machine shop or other branches of mechanical trade. Our plan is that this association should encourage manufacturers to take some definite stand in this direction. How this can be done I am unable to say, but I presume that some of the gentlemen here can give us some suggestions that will assist the association in bringing this matter to some practical end among foundrymen.

Mr. Moore: I have been looking over the suggestions with reference to that branch of trade in which I am particularly interested. The plan is one that is generally used—it is used in a measure in the shops that I am familiar with. The matter of apprenticeship is one that I think should interest us more than it does, and we feel the need of a general interest in the matter more perhaps when business revives and good molders are more in demand than they are at present.

Our own experience in using apprentices has been that they are not particularly profitable. I think there is no profit in them, unless one can educate molders and unless they will stay by one when they are educated. I think about one-half of them leave. We do not use and have not used the number of apprentices which the union is perfectly willing that we should use. We run a union shop and are under some restriction in that direction. The difficulty, and I think some other shops are similarly situated, is in finding work which apprentices can do which will pass muster. There is not enough work that they can do that will be perfect enough to be used without affecting the quality of the output. As a matter of choice, I think we would rather employ journeymen molders, but we appreciate the fact that we must have new molders coming into the trade; otherwise when there is a call for all the molders that the shops can take care of, there

will be a short crop. My impression is that in the past three years there have been fewer apprentices turned out than in former years. Among those shops that find it an unprofitable undertaking there has been no incentive to employ them and also a tendency to employ the men who were dependent upon the shops for support of their families. Molders are comparatively short lived. Statistics on the subject are rather astonishing. Statistics covering the ground were prepared some time ago by the secretary of the National Association of Stove Manufacturers. I presume the figures that he obtained relating to the stove molders would apply generally to other lines of the business. The average term of work of a molder in the trade is short, and there is absolute necessity that enough men come into the business. I believe, as Mr. Carver stated, that it is a matter of very serious importance to the trade that the question of apprenticeship be taken up and put on some regularly recognized basis. It will lead perhaps to a larger number of apprentices taken into the trade regularly.

The suggestions that are made here in regard to machinery and stove molders I think are good. I have no criticism to make upon them.

The bonus, I think, if it were adopted, should be made larger, so as to be a real incentive to the apprentice. My own observation is that unless the bonus is large it cuts no figure. It does not influence the boy at all, and if it is very large it takes away from his earnings, so in a measure it discourages him in the beginning. Between the two we have not adopted the bonus plan at all. We pay boys about as outlined here. There is a general plan which is understood when they come in and if they prove to have the promise of good molders they are retained, and if not the sooner they get out and we get rid of them the better.

The indenture is rather a one-sided affair because the foundryman obligates himself and is responsible, and although the boy may obligate himself there is no law to enforce the obligation.

Mr. Downs: There is employed by the Dixon Crucible Company a man that has been there fourteen years to my knowledge. He has a very bright, nice boy that I have known since he was

seven or eight years old. The young fellow grew up and went to New York in some commercial house. He grew tired of that and said he wanted to learn a trade. He went to R. Hoe & Co., and through him I learned something of their apprenticeship system. They always have from 50 to 100 apprentices in their shops and it is not easy for a boy to get in. They first look up a boy's reference. They they have a rate of compensation. I cannot give you that. They have a complicated system of pay; at the same time there is an incentive offered the boy in the way of a special premium. The distinctive feature is the education of the boys in the evening.

Mr. Cordingly: I agree with Mr. Moore that personally I would rather not have an apprentice. In our country we have all kinds of work and have to pay a minimum amount of wages. The highest priced man is always the cheapest, but we have to put a man on cheap work and pay him a high priced man's salary. After an apprentice has been with us a while he gets the big head. If he is not successful and we reprove him slightly for not getting to the front he is insulted and does not accomplish anything. The result of the whole proceeding is that I would like to see some way of getting along without them. I appreciate fully that there are only a few good foundrymen left. You will look a long way for a good foreman for the foundry and when you find him you will have to pay him just what he asks.

Mr. Thompson: I would favor anything that would tend to educate the coming generation, not because of what it would do for the individual employed, but for the good of the whole community. I think that the system of apprenticeship that has been set forth here would enable the foreman to have better command of the apprentices, and the provisions that are made for giving a bonus would be an incentive for the apprentice to accomplish something to the advantage of the employer in quantity of work as well as quality. I have not any indenture apprentices. I think there are very few foundrymen in Chicago who bind their apprentices for a term of years, but they allow them to come along the best way they can. If they come along

fast they know it themselves as soon as the foreman does and they are ready to take advantage of it. I think it would be a good thing to have some system adopted among the foundrymen to repay them for the interest that they take in the apprentice.

Mr. Cordingly: I suggest that if it were possible it would be well to apply some educational test to the boy entering the foundry. The more ignorant the boy was formerly the better molder he was expected to make. An apprentice in the foundry could stand a little education I think. How many journeymen have we that can tell the contents of a ladle?

Mr. Moore: There are some difficulties, I think, under which we labor even no further west than this, and I think the further west one goes the difficulties increase in contrast with the condition which exists in the east. The further west one goes the more restless and less constant in location are the men and the parents of the boys who naturally come in to make apprentices. Our population is very largely of a roving disposition. Of course, here in a city it is not so easy to see as in a small place where one knows more of the homes of the men that are employed. Our working population is a shifting one and it has considerable bearing on the subject of apprentices.

The best years of the apprentice to the employer is when he gets so he can earn the most money. His first year or two can hardly be profitable even at a discount of 15 per cent. I regard him as an expensive luxury. Now, in the east things are materially different. The population there is stationary. In many places the workmen have been in one locality for a generation or more. When a boy comes to work in a shop the chances are that his parents and his friends and relations will stay there and you will have a more stable condition.

Mr. Stantial: We have had a little experience with the apprenticeship system, not in the foundry but in the machine shop. Our indenture is very similar to the one embodied here by our committee and we have found it to work very well indeed. The bonus that we have been in the habit of giving is from fifty to sixty

dollars at the end of the third year, and, contrary to what one of the gentlemen has here said, we find the apprentice looks forward to it and it is an incentive for him to stick to his apprenticeship until his time is out. I have also had a little experience with what we used to call contract men. You take a man or a good-sized boy, say from 17 to 20 years of age, put him in the foundry, it being understood that he knows nothing about molding, and he is taught to mold. This contract had a penalty attached to it. If the man or boy got tired and wanted to give up his job he forfeited the money that was unpaid. We did not find that this worked well.

Mr. Moore: I think the plan as outlined here is practicable and feasible just so far as the boys can be found that will fill the bill. When they cannot fill their part of the contract I want to feel perfectly free to drop all connections.

Mr. Sorge: I would like to ask the committee from what class of boys they expect these apprentices would be principally drawn. From what class of society and from what kind of parents would these boys come?

Mr. Ferguson: That is a broad question. It would cover a good deal of ground. Sons of mechanics are the apprentices that we would expect.

Mr. Cordingly: As a general thing a mechanic's son is advised by his father to become a lawyer.

Mr. Moore: It would be interesting if some of the gentlemen here present would state their shop experiences as to how many of the sons of molders have become apprentices. I do not think in our own case we have a single one, although we have quite a number of eligible candidates.

Mr. Ferguson: With a working force or forty molders we have five that are sons of molders that are in our employ as well. It will run about in that average. They are laboring men's sons mostly and their fathers have at one time or another worked around the works.

Mr. Sorge: What I meant was the proportion of the sons of molders as compared with the sons of other men.

Mr. Ferguson: There is a lack of the proper material because there is no general system in use, and when any one attempts to adopt a system it is pretty hard. The boys say they can make better terms in other places and have no restrictions placed upon them.

Mr. Johnston: Would it improve the indenture to have the word "optional" taken out. Would it not be better if the apprentice were paid a bonus according to the work he does? You can generally tell what a man is doing from day to day. You are bound to pay him for the amount of work he does. You can tell good work from bad work.

Mr. Ferguson: Would you not have to give him a certain amount of work to be done daily?

Mr. Johnston: If he did one piece of work and that was good, would that not be better than a number of poor pieces?

Mr. Cordingly: It seems to me that this question of how much the boy shall do is a little far fetched, if what he does is not good.

Mr. Sorge: I think Mr. Johnston's suggestion is very good, but I think there should be some definite statement as to what work he would be expected to do.

Mr. Cordingly: The conditions are not all alike and I do not see how you can make general rules to cover all conditions. The first thing is to get the apprentice and then build Mr. Apprentice according to the conditions which surround him. Your class of work is not mine, and so it goes all down the line.

Mr. Ferguson: I do not see but that it is just right as it stands, leaving it optional. We take it for granted that the majority of manufacturers are fair-minded men.

Mr. Thompson: I fail to see anything in the agreement that makes it any better for one party than the other. The compensation is so small that an apprentice will not stay and be a burden upon his employer unless he is very anxious to learn the trade. The matter of bonus will compel the apprentice to accomplish something more than the ordinary, and the employer will very readily recognize that, in order to get better and more work out of the apprentice.

Mr. Johnston: I have been fortunate enough to be told that when things had gone on well I would be given so much. It is a great incentive to work when one gets a pat on the back; whether it is a dollar bill or not, one likes it.

Mr. Ferguson: It strikes me that there is another side to that question. It is all right to pay a premium on quality, but if you confine the premium to quality regardless of quantity, it is bad. I think a man would rather give a boy a five or ten dollar bill than keep anything from him that he deserves.

Mr. Hotchkiss: I have had no experience personally in apprenticeship system as laid down by the committee. We have what we call apprentices, but they are not bound in any way. We pay them the same price as we pay to our journeymen molders with the exception that we have certain jobs that are apprentice jobs. The price is paid according to the difficulty of molding and that class of work is given to these men. We have had very few molder's sons that apply for the job of molding. As far as hiring boys that have graduated from the grammar school, my experience of the last 30 years would lead me to think that such boys do not apply to learn the molder's trade. There is a tendency among machinery molders to belittle the class of work we do. It is not considered molding by some of them. Although we have as good molders as anywhere, there is not the chance for the molder to learn the trade that there would be in some jobbing shops. It seems to me the great objection to putting this report in force is to get the foundrymen to go into it. Of course, the Western Foundrymen's Association is very strong, but we have not the majority of foundrymen in our membership, and unless the greater number of the foundrymen adopt this system, it does not seem to me that it is practicable. Men will perhaps serve one year and then go to some other shop, that is if they could get along a little faster somewhere else. We have men come along every day that have worked in some of the other places.

Mr. Rowlands: My experience with apprentices the last six years has been very similar to that of Mr. Moore's. I have

come to the conclusion that mechanics are the cheapest apprentices. I have had a few apprentices from the country and some of these turned out to be the best I ever had. Where they show a tendency to take an interest I have made a special effort to crowd them along. I have had men that have worked along four or five months and become handy at a certain class of work and they would go to other shops.

I do not know of anything that can be improved on in this report. I think the system is all right. As we are now doing we depend upon the small shops. The small shops in Racine are the ones that turn out the best mechanics. Young men have come to me and I have advised them to go to the small shops to learn their trade. As far as intelligence goes, we do not find it a hard matter to get steady boys, boys with ordinary intelligence. We have a good many boys that have gone through the ward schools. I would be very glad to see a system of this kind adopted and I have not the least doubt that our people would be more than glad to use some such system. There are very few young men that I know of that are learning the trade that remain long enough to make good mechanics. They become uneasy and want to get something where they can make more money.

Mr. Moore: The suggestion made by Mr. Johnston seems to me eminently practical, as most of his suggestions are, and I believe as applied to shops where piece work is done that there is nothing against its being adopted. The data are at hand and I believe it is a real measure of the value of the apprentice and it is a new idea to me. There is one modification that I would suggest, and that is that the rate of discount under which the apprentice works be varied every six months, according to the proficiency that he has shown. I will therefore move that this section be referred to the committee with the suggestion that the terms be modified to incorporate Mr. Johnston's suggestion.

The above motion, being duly seconded, was unanimously carried.

On motion, duly seconded, it was decided that the report of the committee, after having been revised, be again referred to the Association at the next meeting. The meeting then adjourned.

PROCEEDINGS OF THE PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The second meeting of the Pittsburg Foundrymen's Association was held in the rooms of the Builders' Exchange, Monday evening, November 30. Mr. Robert Taylor occupied the chair, and in the absence of Secretary Zimmers, Mr. R. B. Lean officiated.

The special committee appointed by the executive committee to secure suitable quarters for meetings reported that the rooms of the Builders' Exchange had been secured and access could be had at any time.

The subject for discussion during the evening was "Test Bars." Mr. Jas. Boyle, of the Westinghouse Electric and Manufacturing Company, gave results of tests made by the Keep machine, which he said proved very successful. These tests were found to be very satisfactory for light castings. The bars were cast in a green sand mold and were all made of soft grades of iron, the tests being of tensile strength. Mr. Boyle thought that by following up these tests the machine for testing could be depended upon, provided the same care be taken in making tests as in casting.

Mr. Taylor believed that foundrymen of any class should make test bars. Of course, some would use different machines. There are many ways of ascertaining the strength of castings and of making tests. There are also many ways of making test bars, some of which, he said, were highly amusing. Mr. Jos. Seaman gave further results of making tests. Other founders present gave talks on the subject which were of great interest.

PROCEEDINGS OF THE NEW ENGLAND FOUNDRYMEN'S ASSOCIATION.

An interesting and well attended meeting of the New England Foundrymen's Association was held at the United States Hotel, Boston, on Wednesday evening, November 11th. The following four papers on "Foundry Costs" were read, the authors' names being for the present withheld:

1. In response to an invitation from our Executive Committee to prepare a paper on "Foundry Costs," to be read before our Association, we feel our inability to present anything of very much value or to enlighten you with many new ideas.

We will simply tell you how we keep our costs and get our profits or losses, and trust you will pick out all our weak points and discuss them in a way that will make us wake up, get out of our well-worn ruts and fall into line with the latest improved methods.

We start at the beginning of our year with an inventory, taken as carefully as possible. Broken lots of pig iron we count and get the average weight of about fifty pigs and in that way get the whole lot. Scrap and sprues we weigh accurately. Molding sand in shop, we weigh the amount contained in a certain size flask and find out how many flasks a man can put up with that heap.

After getting our yearly inventory we use practically the same figures for a regular monthly inventory, with the exception of a few accounts on our ledger such as merchandise, iron, sand and clay, fuel, etc.

To get at the inventory of our merchandise each month is a small matter, and as we calculate to practically clean out our shipping room each day of all small castings made the day previous, we have very little to weigh up on the last day of the month. We get at the number of pounds of castings made on the last day of the month by taking a certain per cent of our whole heat for that day. We have ascertained this per cent several different times by accurately weighing the castings and

sprues and the iron from the cupola bottom and knowing, of course, how much was melted or how much was put into the cupola.

Every pound of iron is weighed when it comes into our yard, and also when it goes into our cupola. We make a book to charge up from and have a boy on the stage who does nothing but attend to the weighing and checking off the book while they are charging up.

We also keep a book which we call Iron Records, keeping a credit and debit side, which shows at all times, just how much iron we have in our yard of each brand and how much is due us on orders placed for same.

Our inventory of sand and clay we get at by taking the number of pounds consumed during the whole year and finding out how much it costs for each pound of castings, made during that length of time; then multiplying the number of pounds of castings, made during the month in question, by that fraction, which shows how much to deduct from our yearly inventory each month; to this we add the amount carted to the yard during the month.

Fuel can be got at in a similar manner.

We keep our labor accounts separate, that is, by rooms—ware room, core rooms, molders, sundries, foundry laborers, etc.—and in this way get at the cost per pound of the number of pounds of castings made during the month, thus enabling us to detect a leakage in any of the different departments.

By keeping the record of our irons, you can see that it is a simple matter to get the cost of our melted iron per pound; also as easy to obtain the cost of our labor per pound, and then all we have remaining to figure is our general expense, as we call it, consisting of supplies, general repairs, freight, cartage, insurance, taxes, fuel, water, lighting, salaries of officers, book-keepers, clerks, watchmen, engineer, foremen and all other help that are non-producers.

Then by adding these three different costs together—iron, labor, and general expense—we get the avergae cost per pound of our castings made during the month. By dividing the

amount received for the month's business by the number of pounds shipped, we get the average price received per pound, then subtracting the average cost from that amount, gives the average profit per pound.

Here we have a chance to prove that our monthly closings are correct; if we find more than a slight difference between the profits shown in loss and gain account and the profits shown by multiplying the number of pounds by the average profits per pound, we of course know there is an error.

We would state that the difference shown in our loss and gain account for the three years we have used this monthly inventory system and the same account by our yearly closings amounted to only $307.01.

We do not have any good system for keeping the actual cost of any one piece that goes through our foundry, without devoting special attention to it. We know the average cost of our melted iron and general expenses and have simply to add our molding and cores to that.

In figuring a job we know how much our general expenses for a year averages to each man, that is to the average number of men that we employ; thus we figure the number of pounds of iron in the job, find the cost of our iron and estimate the number of days' labor for one man to make it; we multiply that number of days by the average general expense for one man per day, and add the estimated labor and profits.

We realize that the above system is crude and probably not up to the standard, but, as we have said before, we trust that same will be discussed thoroughly, so that we may be able to adopt some better method.

2. The question of cost in a foundry seems at once the most important one and the one most difficult of satisfactory solution. As the writer understands the case, the things to be desired are these: First, to be able to know for a fact the cost per pound of each class of work, or of each separate job in the shop; second, to be able to estimate with reasonable accuracy the cost of a class of work presented for the first time.

So many different items of expense enter into the cost of castings that it is an intricate problem to determine just what part should be borne by each job or each class of work. Conditions vary so in different shops that no rule can be laid down that will fit all cases, and yet possibly a general plan can be presented which will help in some particular case.

It is not a very difficult matter to learn the cost of the iron melted and in the ladle, if one follows closely and intelligently the weighing of the material; but this, the very vital part of the whole investigation, is too often left to the unreliable hand of some helper, who wheels the material to the stage and guesses that it weighed so much, and that so much was on the stage when he dumped his first load, and that so much was left on the stage when the bottom was dropped. Having care that the weights are taken by some one competent and interested to obtain accurate results, set down the weight and purchase value of the pig iron, scrap iron, sprues, fuel and all the other material actually used in the heat or in preparing the cupola or ladles. To this, of course, is to be added the wages of the melter and all the help employed about the furnace. If a careful record has been kept for a year or so of the expense of keeping the furnace in good condition, relining and repairing it, it is known what sum should be added to cover that item for a day. The total of all these items gives the actual cost of the heat. After the cast has been made and the bottom dropped, carefully weigh the sprues, partially melted scrap, if any, in the bottom, and bad castings, if any, also surplus material on stage, if any. Ascertain the purchase value of the whole and deduct it from the cost of the heat, and the remainder will be the total net cost of the iron, and of melting it, for the number of pounds of good castings turned out. Divide it by the number of pounds of good castings and it gives the cost per pound. All this is very simple and perfectly apparent, and if the heat be of an average size and the results about as usual, a single day's test is as good as any number of days, and the results can be accepted as correct.

It is perfectly clear that in small heats the cost per pound of melting the iron will exceed that in large heats, but whether the

heat be large or small, one making this test for the first time will be surprised to find how little it costs him per pound to melt his iron, and how much iron he loses in shrinkage.

To find the other items of cost, that is, labor and expense, is not so simple. Indeed, it may be set down as impossible to frame any formula that shall exactly meet the first requirement named at the commencement of this article, viz., absolute accuracy in reckoning costs. There are too many indefinite factors, too large an element of uncertainty and risk in practice, and too many variable quantities. Still, it is believed the following plan, if carefully followed, will fairly meet the second requirement mentioned, viz., estimating new work with reasonable accuracy.

The first step is to learn the total fixed charges for any given time, preferably for one day, as in the case of iron and melting. Under the head of fixed charges the following are to be included, and for convenience they are to be reckoned for a year, and the total divided by the number of working days in a year.

Rent or interest on investment, taxes, insurance of all kinds, depreciation of plant, water rates, lighting, heating, office expense, superintendence, power.

There are other charges which vary with the volume of business done, but which can be reckoned approximately from the books of the previous year's business, such as teaming or freights in delivering castings, carpenter's time and lumber in keeping flasks up to value, and barring off and altering same.

Then there are also the supplies, core sand, molding sand, facings, flour, beer, small tools, brushes, rammers, shovels, etc. Coal for core ovens, and all the thousand and one petty items which constitute one of the great "outs" in the foundry business, and which are usually charged off on the books under the comprehensive heading of "Miscellaneous Expenses." Then add as much as your self-esteem will permit and as little as your conscience will allow for "bad debts." Count in under the head of "Unproductive Labor" every dollar of your pay roll except the molders, coremakers and chippers, and by that time you will begin to realize that the reckoning of costs in a foundry is a very

serious matter, and that it differs greatly from any other reckoning of costs that you know of. You will wish at once to raise the prices of every customer on your books, for you will begin to understand what a load of expense each pound of your output has to bear.

After you have got the total of all these items for one year or for one day, as you choose, ascertain what you have paid your productive help, your molders, coremakers, and chippers, for the same time, and divide the sum you have paid them by the total of all the expenses as indicated above. Your answer will be the proper percentage to add to your wage account to cover the actual cost of your labor and expenses.

In reckoning the cost of any one piece of work then, you would add together three items. First, the wages paid your molder, coremaker, and chipper; second, the percentage of that sum ascertained as above described; third, the cost of your iron melted and in the ladle. If a new job were offered you would guess as nearly as you could how much work the union would allow your molder and coremaker to turn out for a day, how long it would take your chipper to clean it. You would reckon their wages, add your percentage and the cost of your iron, and if your guess as to the weight you would get for a day were a close one, you would have a figure very near the cost of your casting.

This method has its objections, but it is claimed for it, that it is as nearly correct as any method can be under the unavoidable conditions of actual practice. In order to be brought very close to perfection a schedule of expenses should be made up quite frequently and new percentages obtained as the volume of business increases or falls off. The same rule applies here as elsewhere, the more castings made, the cheaper they are made, and vice versa, because the fixed charges remain the same whether the output be large or small.

The correctness of this method is capable of proof by reckoning your profits for a year in the usual way from your books, and reckoning your cost by this method. If the account has been

carefully kept they will be found astonishingly near together.

In conclusion, let us hope that the time is at hand when foundrymen will not have to meet such competition as will compel them to split hairs in reckoning costs.

3. Under the above heading, we propose to explain briefly the method we have followed in ascertaining the probable cost of the manufacture of a given piece of casting.

We keep an accurate record of the weight of all castings shipped, so that we can easily find the total for any one month or year. From our annual stock taking and closing of books we get the total net cost for the previous year of material used, such as coal and coke, sand, and other supplies, also of iron and labor, as well as our fixed expenses like salaries, insurance, taxes, etc. By dividing the sum of all these totals by the total weight of castings shipped during the year, we find the total average cost of each 100 pounds of castings made.

Furthermore, we separate the acounts above referred to into three or four groups, and by dividing the total of each group by the total weight of castings shipped during the year, we break up the total net cost of 100 pounds into three or four items. One group consists of such accounts as coal and coke, sand, lumber for flasks, and other supplies; another of salaries, insurance, taxes, and fixed or incidental expenses. The iron account we leave by itself, and the labor account we subdivide somewhat by going over our pay-roll and deducting all sums paid to molders, so that we may know the cost of coremakers, chippers and all except molders.

Now, to make our meaning somewhat clearer, we will state how we should proceed in a given case to find how much it would cost us to make one casting of a certain kind.

First, ascertain the weight of the casting; then the following items of cost:

1st. Iron. This we get from the average cost of the pig iron and scrap used per 100 pounds of castings made during the previous year, as above explained; or, if the market price of pig iron and scrap has materially changed, from the present price of the same. The former method has the advantage that it covers all loss from imperfect castings returned.

2d. Labor of molding. This we can tell accurately, as we know how many pieces of the given kind will be considered a day's work.

3d. Cost of labor outside of molding, and of coke, sand, and other supplies.

4th. The proportionate amount of salaries, insurance, taxes, etc., applicable to this piece of casting. The amount for each of the last items we obtain from the results of the previous year's business in the manner previously indicated.

The process above outlined, if not strictly the best method of ascertaining the cost of manufacture of castings, is at any rate the best that we know of, as our business is conducted. Some may prefer to weigh all the iron, coke, and other material, used each day, as well as the finished product turned out. This, of course, requires considerable time and care, and so increases, to some extent, the expense of running a foundry. Moreover, there is a liability of a good many inaccuracies in the course of a month or year.

The value of our method depends somewhat on the care with which the account of stock is taken at the beginning and end of the year. It would be difficult and expensive to ascertain the exact quantities of the heavier and more valuable portions of the stock on hand in a foundry, such as pig and scrap iron, coke and sand. We therefore make as accurate an estimate of these items as possible, being aided in this by our experience of former years and some rules of measurement which we have established.

For example, by measuring a few piles of pig iron, the weight of which was known, we have found that about nine cubic feet equal a ton of 2,240 pounds. We feel that our results may be accepted as practically correct.

4. Each different class of foundry needs a different system, for what would be adapted to one shop would not be satisfactory for a shop doing a different class of work, though I think we can each learn something from hearing the system explained that is used in another shop even though they do not make the same class of work. There is apt to be something said that would aid us.

In keeping costs in a foundry it is essential that you do not cover the shop with red tape that will add materially to the cost of the finished product.

There are a great number of foundries that either make no pretention to keep the cost or if they do, they do not follow up the subject far enough to know whether there is a profit in a certain line of work or not.

It is a simple matter when you wish to figure on a particular job to figure that the molding costs so much, the iron so much per pound or ton, and if we can get a certain price, think it will cover the incidental expenses of coke, sand, etc. In figuring this way you are totally in the dark as to the cost of incidentals which enter into the cost of every casting.

It is a great deal better to know when you figure a certain job that your expenses are so much per pound and then iron, labor of molding costing so much, you know exactly what to charge to receive a profit for your labor.

Our system, while not perfect, yet for the time required to keep same, I think it gives as good results as anything we can have. I have prepared a copy of system used by us and present herewith.

We start at the first of year with account of stock, which is entered in table each item as iron, sand, coke, etc., under their separate headings.

Everything that is bought is entered each month under the proper headings. The cost of molding, coremaking, foundry laborers, furnace men, cleaners and carpenters is taken from the pay-roll each week and subdivided into these separate divisions and entered. The number of pounds of castings delivered and the amount of same carried into the last two columns.

At the end of the year take your average cost per pound or ton for each item; you can take these averages for each month if you desire, or take each month and then at the end of year a grand average for the twelve months.

If your work has not varied to any great extent, your expenses will average very close from month to month near enough so that you can use last month's figures for this month's average.

While this will not be an absolute rule for all classes of work which you may be making, yet it will be an approximation which will be found much better than guess work, and you can again subdivide some of these items if you cared to to meet the different classes of work.

When a job comes in to be figured, knowing what your incidental costs are, it is a comparatively easy job to figure; you know what the molding will cost, for the Iron Molders' Union have set that for us, so that we will not have any trouble, then add the price of iron and your incidentals as per table, and you will know what the job will cost per pound.

It will be a surprise to some of the foundry men who have never kept costs to know to what a large sum the incidentals will actually foot up to on each pound of castings delivered.

To illustrate table presented herewith, let us suppose that the item of carpenters has cost you each month $150.00; you enter same each month under proper column and at end of year you have a total for carpenters of $1,800.00; then look at amount of iron you have delivered, you find 1,800 tons. Figuring this, you find it would cost you $1.00 per ton for each ton delivered for carpenters.

Take the table of iron, you start the year with a given number of pounds, you buy during year and add to same, at the end of year you take account of stock again and subtract from total amount and balance will be the amount or iron sold or wasted. You know from your table exactly how many pounds of iron you have sold during the year, the difference will be amount of shrinkage.

Under this system, when you come to your yearly stock-taking, your books should balance with this table; everything that has been spent during the year is here under its proper heading and can be seen at a glance.

While it may take quite a while to explain any system, either this or any other, yet the actual time devoted to keeping same, after once started, is so slight, that it would not be noticed.

Your book-keeper can keep the several amounts on the books entered under the proper headings and copy from ledger once a month, onto table, in a very short time.

1896	Iron.			Sand.			Coke.		Molding		Core Makers.	
	LBS	COST		LBS	COST							
Invoice												
January												
February												
March												
April												
May,												
June												
July												
August												
September												
October												
November												
December												
Total - -												

The rest of the subdivisions, such as foundry laborers, cleaning, carpenters, furnace, interest or rents, salaries, teaming, flour, facings, lumber, foundry supplies, returned castings, castings delivered, pounds, amount sold, are carried out in same manner.

A REVIEW OF THE FOUNDRY LITERATURE OF THE MONTH.

AMERICAN MACHINIST

November 5—L. C. Jewett, in a semi-comic letter on "The Bottom of a Foundry Cupola," gives some advice that is needed in more than one foundry. Trade papers seldom find their way as far as the cupola tender, but if those who have his welfare at heart would pick out such articles as the above and call his attention to the good points therein, they would, in the better service he would render them, be amply paid for their trouble.

It is a favorite expression of managers that their foremen are behind the times; likewise the foremen believe their men are not what they should be. If an inclination to assist in obtaining the results of the best practice was shown from the top down, we should probably have better managers, foremen and workmen.

Horace L. Arnold has an article on "Inserted Tooth Mills." As many firms operate machine shops as well as foundries, they may be interested in some of these examples of casting teeth directly in mills. In closing, Mr. Arnold says:

"There seems to be a field of very considerable extent in which the cast-inserted method of mill-tooth securing can be made an economical factor of machine finishing, and the construction of mills by this method can hardly be regarded as a doubtful experiment in view of the successful examples of use here given.

"It is, of course, necessary that the parts of the teeth which are to be surrounded by the melted cast iron should be properly cleaned and protected from rust; I think it always safe to tin any wrought-metal surfaces which are to be cast in place. It is often thought enough, however, to merely put the pieces over a rough emery wheel and set them in the mold of green sand, bright. In this case, if the mold stands any time before pouring, there is always a chance that the bright surface will rust, and it is well known that rust will effectually prevent anything like a union

between solid metal laid in a mold and cast iron poured around it. I think it better to paint the bright work with white lead or simply boiled oil, rather than to put a freshly ground bright piece, naked, in the sand mold; but tinning is the better practice, and I have no doubt would greatly aid in securing the teeth firmly in the cast iron.

"Probably this rough-and-ready and extremely cheap method of inserted-tooth mill construction will meet with strenuous disapproval from the mill-makers who follow the elaborate and costly methods of inserted mill teeth which are in common use by the leading tool-makers; nevertheless, I expect to see mills made as I have described very largely used."

November 26—S. T. Freeland illustrates "Casting Storage," as seen by him on one of his recent visits, and many a foundryman will know the truth of this paragraph:

"We have all heard of the shops built by the man whose foundry could produce castings, and whose machine shop could work them up, but 'in the interim between operations there was no place where those castings might rightfully lay their heads.' So they were everywhere and nowhere, and mainly 'cluttered' up the machine shop, and it was usually easier and cheaper to order a new casting from the foundry than to find one ready made among the lathes and drill presses, or the partially completed machines, on the erecting floor."

THE ALUMINUM WORLD

Says of brass and its manufacture:

As previously stated, the great trouble is in successfully combining a very volatile metal, and one which is as readily oxidized as zinc, with copper having its fusion point so very much higher, and the proportions of a mixture which are found by analysis to vary extensively from those which were put in the crucible. The best way probably to make brass where it is being manufactured from both new copper and zinc, is to put all of the copper in a crucible and melt it, covering it with charcoal so as to prevent oxidization, as well as to prevent the metal from absorbing the

gases from the fuel. This is a point which does not always receive the proper amount of attention, for if a fuel is used which contains many gases, they will be absorbed by the metal, and the best fuel over which to melt copper is coke, then charcoal, oil and gas, about in the order named, but it is very hard to get good results with the ordinary coals, and in some cases impossible.

After the copper is melted and has assumed a very red and sluggish appearance, the zinc should be added. It is necessary, however, not to add the zinc too fast or the low temperature of the cold zinc going into the hot copper will, as the founders term it, "set" the copper, which if done will cause an excessive loss of zinc, for the reason that the copper has then got to be raised to the proper temperature in order to melt it, and as the zinc is in the pot that much longer than it should be, more of it is volatilized than is really necessary. Before the zinc is added it should be thoroughly warmed in order to drive off all the moisture, for the reason that if it contains any moisture it will form steam in the copper and cause an explosion.

After all the zinc has been added, the mixture should be well stirred and allowed to remain on the fire until the whole mass has been raised to the proper temperature for pouring, which is denoted by the zinc burning in a blue flame on top of the pot. Just as soon as this blue flame starts to appear, the pot should be removed from the fire and the metal poured instantly. The melting point of brass is also different from that of copper. It is impossible to give any definite degree of heat which will melt brass, however, as this varies with the proportion of zinc used, and also with the quality of the zinc, and it ranges all the way from 1021 degrees Centigrade to 550 degrees Centigrade.

The larger proportion of copper that brass contains, the softer and more ductile is the metal, and by the addition of zinc the metal becomes more brittle and harder. Tin is sometimes used to give the brass additional strength, but of course as soon as this is added it makes a more expensive mixture. A bronze for fine work is often made by using 80 per cent of copper, 17 per cent zinc and 3 per cent of tin. The red color of copper fades

gradually into a yellow and becomes golden yellow when about 40 per cent of zinc has been introduced into the mixture. From this point an increase in the proportion of zinc to about 60 per cent will produce a still lighter color until this amount has been reached, and if the zinc is increased above this amount it starts to assume a bluish white appearance, so one can tell how great a percentage of zinc a mixture contains by the color of it. This, of course, is a matter of experience, and can only be accurately told by long practice, and of course from what has been said above, it will be seen that as the color of the metal changes the strength and ductility also change.

THE MECHANICAL WORLD

(Manchester, Eng.)

Joseph Horner, in continuing "Modern Engineering Workshop Practices," says:

With reference to chemistry in the foundry, we may say that practically, at least in England, it has no place. Pig is bought of known grades, and the chemical composition of that is known. But the practice of mixing scrap with pig to suit almost all classes of work renders this knowledge of small value, because all grades of metal occur in scrap. Actually the founder estimates the quality of the scrap by the method of its fracture, and by the aspect of its fractured surface. And he judges of the quality of the castings which result from the mixtures made, by means of the test bar, or by the aspect of a fractured runner, or by previous experience of similar mixtures. This practice renders chemistry of little avail.

THE FOUNDRY.

In "Some Pencil Sketches of Failures" H. Hansen illustrates some of the failures that happen every day in the average foundry, and also the causes leading up to these. The general trend of Mr. Hansen's article is shown by the following extract:

It is sometimes thought advisable or necessary to remove the dampness from the sand in certain parts of green sand work.

Once started it becomes a habit with a molder to skin-dry things here and there, gets to be a sort of a second nature to him. If there is too much dampness in the corners of that pocket what caused it? An injudicious use of the swab. That is a pretty fine argument, swab a mold too much and then drying it out, because you put it on there. Why not apply water to a mold with a spray can, if you can't twist your mouth up and blow it on like a Chinese laundryman? The corners are hard, you say, and for that reason need drying. What made them hard? You had to cut a fillet. But you didn't. After swabbing the corners you got a piece of a cigar box and with that new Monks spoontool you bought last week you sleeked those corners until there seemed to be a respectable fillet. When you drew the pattern these corners were in such a condition that the iron would have laid to them without a kick, but now you have got a hard wet corner, and whose fault is it that there has got to be some drying done? * * *

S. S. Knight, in writing of "The Influence of Heat Upon Cast Iron," says:

It has long been asserted that iron when heated above the melting point would lose its silicon, then its manganese and phosphorus, and lastly its sulphur. In fact, so strongly is this believed that foundrymen throughout the world calculate to use iron in the same mixture which will average from .3 to 1 per cent higher in silicon than the castings require, regardless of the amount of carbon or manganese and titanium which these irons contain. In considering the amount of silicon a mixture should contain the carbon should also not be neglected. An iron containing 5 per cent of silicon and 4 per cent total carbon is worth more than a hundred with 4 per cent of silicon and 2 per cent carbon. Silicon without carbon is worthless to decrease shrinkage, silicon with carbon in the presence of manganese and titanium in any quantity is worse for the same purpose. The reason is obvious.

Carbon will combine with manganese and titanium at a temperature not far above the melting point of iron, thus destroying

whatever graphite the iron contained and forming the carbides of the two metals named. While this is often the case in the melting of iron, it is erroneous to suppose that hard iron, i. e., iron high in combined carbon but lower in graphite, can be made soft by simply mixing with it an iron high in silicon, but low in graphite. Carbon may be easily combined, but to reduce it again to graphite is quite another matter. But providing that too high a heat is not used this may in part be done. The carbide of iron is far more easily broken up and reduced by silicon than that of titanium or manganese, * * *

W. J. Keep, in his "Cast Iron Notes," treats of the "Comparative Value of Charcoal and Coke Iron for Cotton Machinery Castings," during which he mentions the following:

Charcoal and coke pig iron can be found which would show the same chemical composition. There is a difference, however, which cannot be accounted for by chemical analysis. Charcoal pig iron is generally made at a lower temperature and at a slower speed than coke iron, but this will not account for the difference.

By selection of ores charcoal iron is made that has as much silicon and which has no more chill than coke iron, and it is also made with low silicon and still have no chill.

Such irons are suitable for the making of malleable iron castings.

Until quite recently such iron was considered necessary for this purpose, but for some time it has been found that as good malleable castings can be made from Bessemer coke irons. Irons as low in sulphur and phosphorus can be made with coke as with charcoal, though sulphur is more generally low in the latter because there is less sulphur in the fuel.

Such non-chilling charcoal iron can be melted in an air furnace and the silicon burned out until it becomes gun iron. Charcoal iron so treated will make a stronger casting than iron with seemingly the exact chemical composition melted and cast directly in the molds.

Such iron with its silicon burned out, if put in small castings, or if cast against a metal mold, will run white, but will turn gray at the center of a large casting, but the white portion is not a true chill.

THE IRON AGE.

"Testing Cast Iron Wheels" forms an interesting sketch in one of its issues. To properly acquaint the reader with its contents, it is here reproduced in full:

"Testing Cast Iron Car Wheels."

At the Altoona shops of the Pennsylvania Railroad a method of testing car wheels has been in vogue for some time which is creating a good deal of discussion. A sand mold is made around the tread of the wheel, which leaves a space of about 2 inches wide between the sand and the tread. Melted iron is then poured into this space. The American engineers report that most of the wheels tested in this way broke or cracked in from 25 seconds to 1½ minutes from the time the metal was poured.

Many claim that the thermal test is not a practically fair one and is calculated to unduly alarm the traveling public. Nevertheless, the Pennsylvania Railroad officials at Altoona have been developing the test, and have reached the conclusion that in specifications for car wheels which they buy a certain number in each lot received shall be subjected to a test of this kind, and if they do not stand it all are to be condemned. An extensive series of investigations were made before this conclusion was reached. More than 200 wheels were tested, of which a large proportion—about nine-tenths—were broken or cracked. The fractures were very curious. In a large number they occurred just inside of the rim and extended circumferentially for a distance varying from a fifth to a third of the way around. In some cases the wheel was merely cracked, the fracture not extending through the rim, but in others the rim was broken radially to the circumferential crack, and a piece was entirely detached from the body of the wheel. In others the break would be on a line approximating to a cord drawn to the periphy of the rim or tread. Another form of break was on a circumferential line, about half-way between the hub and rim, or where the double plates join the single one outside of them. Nearly all the wheels tested were of the Washburn, so called, double plate pattern.

These cracks also extended from a fifth to a third of the way around, and were sometimes confined to a circumferential line, and in others would extend radially from one or both ends out to or through the rim. In some instances these fractures were mere cracks, while in others a piece was bodily detached from the wheel. Often the break occurred before the molten iron had solidified, and with such violence that it was scattered out of the mold in a way that was dangerous to the bystanders. Another curious phenomenon was the fact that often a secondary fracture would occur after the first one and on the opposite side of the wheel. The two would not always occur at the same part of the wheel section nor in the same form. Some or all of the brackets or ribs were broken in nearly or quite all the tests, even when the plates were not fractured. Mr. McLean, the superintendent of the foundry, who made these tests, obtained five double plate wheels of the old pattern made by the Lobdell Company in Wilmington, Del. None of these wheels broke into pieces; several of the outside plates developed short circumferential cracks, which did not destroy the integrity or the wholeness of the wheel, and it was only the outside plate which was fractured. Altogether, they stood better than any other form that was subjected to the test.

Another fact which was ascertained was that wheels which had been in service, or second-hand wheels, did not stand the test as well as new ones. Altogether, the Altoona wheels have stood the tests better than any others, excepting the double plate Lobdell pattern. Some of the Altoona wheels were broken, but many of them stood the test without fracture. It is proposed hereafter to take three wheels from every 100 and subject one to a drop test and two to the thermal test.

A molding machine built by the Bryant Iron Works of Buffalo, N. Y., forms, from a foundryman's standpoint, the principal part of a later number. This machine is built for a special casting, and is therefore unlike most now on the market, which permits of making a rapid change of pattern if so desired.

THE IRON TRADE REVIEW.

Publishes a number of letters received from foundrymen in response to the question: In what direction is there greatest room for improvement in cupola practice in the foundry?

We append the principal part of these answers in a condensed form:

A. Sorge, Jr.: * * * With our present method of running the cupola in a foundry for only a couple of hours each day, there can be very little gained in the way of economy by attempting to store this surplus heat. I consider the employment of center tuyeres as being in the direction of more effective use of the blast, but I look for considerable improvement beyond this in following the practice of the blast furnaces.

In a general way I would state that I anticipate the adoption of continuous or more continuous melting in the foundry. As soon as this is done, it will become possible to economize largely on the fuel, and to control the blast in intensity, volume, temperature and composition.

Wm. Ferguson: I consider the introduction of any hot blast system impracticable, for the reason that foundry heats as a rule are of too short duration to derive any or enough benefit, to pay for the putting in and maintaining of a hot blast system. Neither do I see any hope for economy in the center blast in ordinary cupolas, because we have at present no trouble getting sufficient volume of air into center of our largest cupolas to create thorough combustion of the fuel. Any economy that has been developed in the cupola in the past 25 years, is in my mind due not so much to improved appliances as to a more thorough understanding of the principles of melting, proper regulation of charges, so as to melt the greatest amount of iron with the least possible fuel, and a proper application of the blast. * * *

H. H. Leonard: I think that in common practice tuyeres are too high. Better results will be secured by having tuyeres as low as possible, and drawing the iron out of the cupola, instead of holding it in to keep it hot. * * *

S. Groves: In my opinion, the greatest room for improvement in cupola practice is not in the direction of internal shape of lining, or form of tuyeres, but in the heightening of the charging hole; the common practice is to locate the charging hole altogether too low down near the top of the tuyeres, and is a fruitful cause of wastefulness in the item of fuel. Instead of allowing the hot gases above the zone of fusion to pass freely into the atmosphere, let the heat of these surplus gases be utilized in the warming of heavier loads and thus deliver hotter metal down to the melting zone.

Another line of economy will be in foundrymen demanding that their pig iron be supplied from the blast furnace, free from sand. * * * Sand-free pig iron means that the necessity for fluxing will be reduced to a minimum; since the charges will no longer be clogged with the fused glass-like silica from the sand—with which the oxide of calcium combines and floats out of the slagging hole as a liquid cinder. From this change will result two economies: (1) Saving in the use of limestone or other form of carbonate of lime, as flux; (2) saving of heat energy expended in the dissociation of the carbonate of lime into carbonic acid gas and lime. * * *

Thos. D. West: There is room for improvement in cupola practice with most all founders, especially in the saving of fuel and linings. "Center blast" offers greater benefits in this direction than any new departure now known. * * *

Geo. A. True: There is undoubtedly room for improvement in cupola practice, but in my opinion it lies in a better understanding of proper charging methods, and in the amount of blast delivery, rather than in any special construction of the furnace ieself. * * *

W. N. Moore: Under conditions which favor a practically continuous operation of the cupola—such as in the converter, and possibly in car wheel shops and pipe foundries—the natural line of progress would seem to be in the incorporation, with the cupola, of the bell top and hot blast stoves, practically reproducing blast furnace construction. * * *

Edward Kirk: The application of hot blast to cupolas—a question recently discussed in your columns—has been thoroughly tried in this country, and in every case has proved a complete failure. * * * With the modern furnace, hot blast stove and a low cupola, a hot blast could probably be applied to a cupola, but it is doubtful if the saving effected in fuel or increase of output would justify the expense.

There does not appear to be any chance for any great improvement in cupola construction, for there has been no improvement made in the past twenty years. At the beginning of that period we had the round cupola with a single row of round or flat tuyeres as the best and most economical melter. To-day the same cupola is more extensively used than any other and does the most economical work. During this time many new designs of cupolas have been introduced as fuel savers and economical melters, and some of them came into very general use in certain sections of the country. But they have all proved to be more or less of a failure, and many of the improved cupolas that were considered necessary to the foundry's existence in years past, are now only used to save the expense of replacing them with new ones. The patented cupola of to-day will share the same fate, for the only cupola that has stood the test of time as an economical melter is the plain round cupola with a straight or boshed lining, according to size of cupola. * * *

H. M. Ramp: More brains on the charging scaffold. * * *

Wm. D. Sargent: The tendency of the present day is to specialize, and it is only by the concentration of an important line of castings in one plant that economical operation can be maintained. With sufficient tonnage of a uniform character the cost of melting is a comparatively small percentage of the total cost of production, and with the use of a satisfactory fuel, I do not believe that a radical improvement over the present practice is likely to be effected.

James A. Beckett: There is no reason to believe that any great improvement will come through the invention of a new cupola, for it is doubtful if any great saving in fuel could be

made, over the best work of the best cupolas now in use. Whatever improvement is made in general cupola practice in melting iron for foundry purposes, will have to come through a more intelligent method of dealing with the various details of cupola practice, founded upon a better understanding of cause and effect; a common sense application of the principles which govern the attainment of the best results in melting iron in the cupola. And this will prove to be a happy medium between the microscopic methods of the scientist and the reckless rule-of-thumb methods of those whose success depends upon luck and the clerk of the weather.

THE RAILWAY REVIEW

Publishes a series of articles under the caption of "Modern Iron Working Appliances," illustrating the same with examples of tools in actual use, the first part of this being devoted to foundry equipment. In the issue of November 7 "Cupolas and Ladles" are considered. The second part, appearing in the edition of November 14, treats of "Wheel Casting and Light Cranes." "Molding Machines and Blowers" are presented in the number of November 21, the whole being supplemented with eighteen illustrations.

THE TRADESMAN

In an editorial on "Carrying Pig Iron to England," says:

The British press admit that American pig iron has been imported into England in considerable amounts in the last two years. They also admit that the quality is good and prices satisfactory. That sold in England, so far, seems to be mill and No. 2 foundry. But our confreres of the English industrial newspapers are very sure that nothing but very abnormal conditions of the trade on this side could make it possible for our Alabama iron masters to lay metal down in Glasgow or London, below any quotations the Stockton smelters will make. We admit that depression of all raw materials of manufacture here, has, in part, enabled our furnacemen to produce iron at less cost than it was ever produced anywhere in the world; but there is more in this

matter of cheap prices of production than low wages and consequent cheap ore, coke and fluxing material. The American furnace is as far superior to the average English, Scotch and Welsh furnaces, as the latter are to the blast pots of seventy-five years ago. Our masters get from 10 to 40 per cent more product from a given amount of coke than the British masters get. We work fewer hands to get the same results; and we may say, incidentally, that this enables the trade here to pay better wages.

But the striking fact is that these shipments can be made at all, without the American producer incurring ruinous loss. Ten years ago the English press and public received a prediction that American pig iron would be shipped to Great Britain, as a regular and legitimate business, before the end of the century, with shouts of laughter. The idea was ridiculed without stint or mercy; but here is the materialized fact, all the same. Its existence, taken account of broadly, proves that it is a fact that has come to stay. Now it is trifling in amount, as all infantile commerce must be.

As British fuel and ore rise in cost, so must the cost of making pig iron go up. The lowest cost sheets in that country were round $7 a ton. Our lowest have been round $5.50 a ton—and there is the key to the mystery. Our cost price need not advance appreciably for the next fifty years. In that time the British cost price cannot fail to increase one-half, and probably it will double. It follows that English manufacturers will buy their raw iron largely from our furnacemen, because they will be able to get it cheaper here than at home.

A correspondent, in considering the claims that have been made for the use of aluminum in connection with other metals, sums up his conclusions in this way:

Assuming that what is above affirmed of aluminum is reliable, it would appear that its use in the foundry in many exigencies would be highly profitable.

I know something of aluminum, having used it in casting both alone and in alloy with copper, but have never used it as an alloy with cast iron. It is much used by manufacturers of brass. It

melts at a low temperature, and therefore a quantity of it thrown into a ladle of molten metal would melt at once.

The fact that a small quantity added to molten iron prolongs its fluidity is an important circumstance, especially in a small foundry, where it is often difficult to accumulate enough molten iron for a heavy casting. This feature alone might have the effect of enlarging the capacity of a small foundry. Then its property of promoting graphitic separation ought to improve the quality of castings where much scrap is used; or would make possible the employment of a larger per cent of scrap. A knowledge of this fact would be of great advantage to country foundries remote from pig iron markets; in fact, it might be invaluable to such.

As to its tendency to prevent blow holes, as alleged, I must confess I am somewhat skeptical. There is an amazing number of writers who do not know the difference between a shrink and a blow hole. A "blow" is caused by the intense heat of the iron generating gases that cannot escape from the mold cavity. An internal shrink hole is caused by solidification of the outer shell of the casting prior to that of the inner mass, and as this inner mass continues the process of shrinkage, it sometimes causes a separation of the molten or fluid from the solidified iron in spots or at various points in the casting, leaving a vacuity. And this latter is probably the defect which the aluminum corrects.

To prevent a blow hole it must reduce the heat of the iron, which it does not do. To prevent shrink-holes, it must promote separation of the graphite—and that is just what is claimed for it.

THE IRON MOLDERS' JOURNAL

"Squire" has a well written article on "The Jobbing Shop and its Foreman." That the foreman of a jobbing shop needs to be a better informed mechanic than his brother engaged in specialty work is a fact, the observance of which is often violated, entailing a heavy charge upon the one who inaugurates the experiment. There is probably no position in the foundry that so taxes the ability and resources of a man as that of being foreman in a jobbing shop. The following is an abstract from the paper:

Upon the foreman of a jobbing shop rests considerable responsibility as to its success. If he is a practical man, with up-to-date ideas, and a fair mechanic, actuated by a desire to make the best returns for his employer, and at the same time be considerate of the welfare of those who work under him, he can do so by exercising a little judgment, care and common sense. A foreman who does not study the interests of his employer can never be a good foreman to those who are under him. The best results and returns are given him who in studying the interests of the one also works for the welfare of the other. Too often we see an inferior mechanic placed in charge, who hardly gets the position before becoming inflated with his own importance and knowallism. Instead of considering and studying the ways and means by which work can be turned out, he prances and roars around the shop like a bull puncher, giving advice to those who do not need it, and abusing those who do. His assinine bossyism fills the men with disgust and dislike, and the returns to the proprietor are not what is shown by a quiet, sensible foreman, who knows what a foreman's business is and does it. If a molder does not suit a foreman he has always the privilege of letting him go, but this can be done in a manner that will retain the friendship and respect of the one discharged, just as well as in a fashion that makes a man almost feel that he is neither fit to live or fit to die, and raises in him that feeling of resentment that forebodes no good for future relations. It is a foreman's right to demand and exact from his men a fair day's work, and to this no reasonable person can object. But to the contemptible practice some have acquired of walking around to a molder after he has finished a fair day's work, with a small pattern, or what is commonly called a "stump," and expecting him to make it, is due much of the friction found to exist. The amount of labor, in itself, may not be great, but it is the galling sense of injustice and manifest unfairness of the thing that stings. The petty tyranny that prompts such despicable conduct on the part of the

foreman in crowding those under him, stamps him as one who has forfeited all claim to their deference and respect, and proven his unfitness to act as between master and man. It is this class of foremen that fosters and breeds the spirit of resentment and discontent, so much to be deplored, that is too often the forerunner of that industrial strife which finds its vent in that most undesirable state of things in any shop—the strike.